Instrument Hazard Analysis Document (IHAD)
Experimental Endstation: COLd Target Recoil Ion Momentum Spectroscopy (COLTRIMS)

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Location of Work: 002-0102 and Advanced Light Source
Date of Preparation: September 30, 2014
Division: Chemical Sciences
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Notes: none

Note: - This IHAD covers the development and operation of the COLTRIMS apparatus in its lab in Building 2. Each time the endstation is installed on the ALS beamlines floor, it is subject to all of the normal safety review requirements for an ALS experiment. An ALS Experiment Safety Sheet (ESS) must be completed online well in advance of the scheduled beam time, and the endstation will be inspected by ALS staff.

Description of Activity:

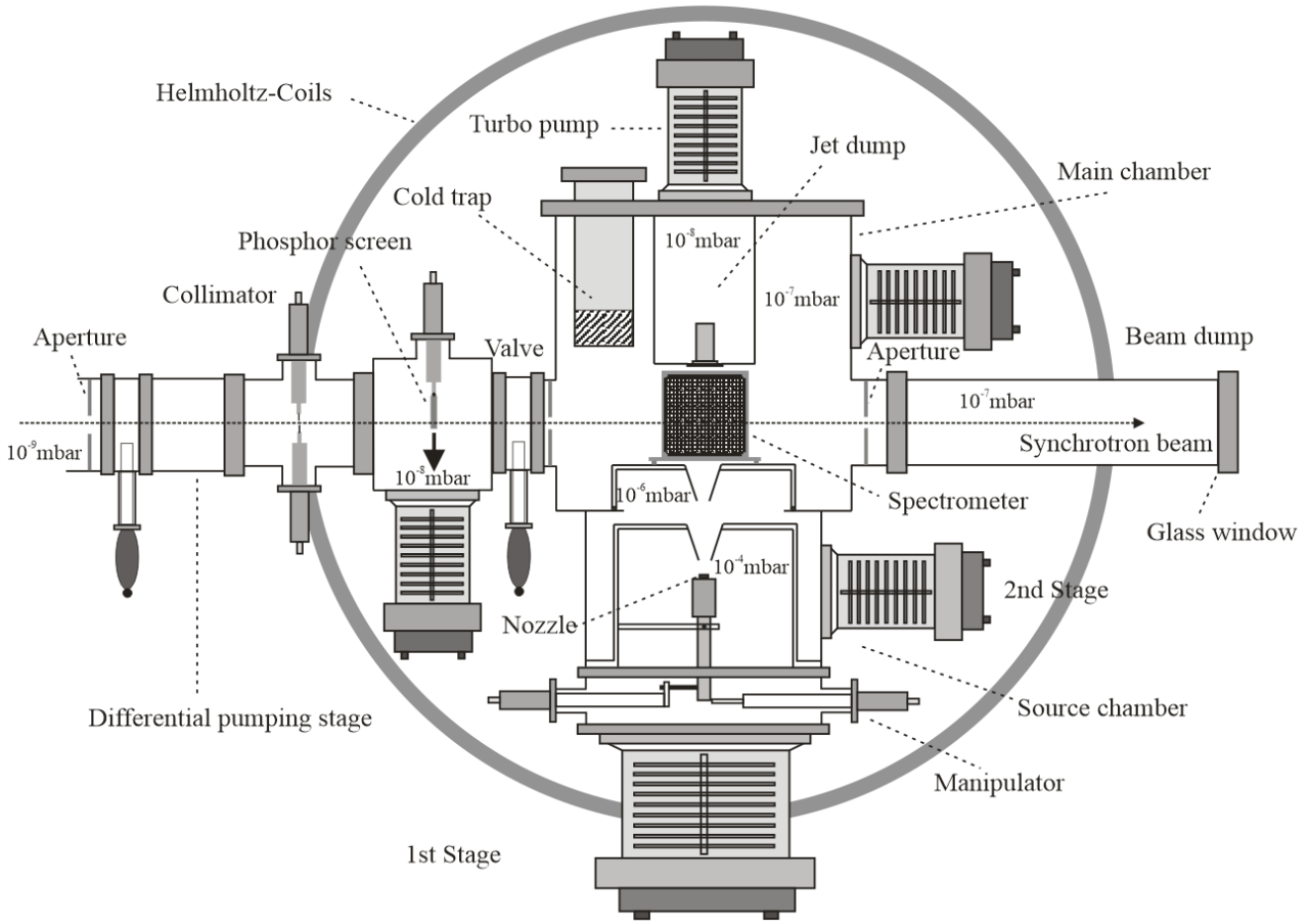
The COLd Target Recoil Ion Momentum Spectroscopy (COLTRIMS) apparatus is an endstation, which is used for gas phase experiments at the Advanced Light Source (ALS) during two bunch mode (March and August). It is maintained and further developed in building 2, lab 102.

The setup is a vacuum system (operating pressures <1E-4mbar) and consists of I) a differential pumping stage, II) the main chamber, which has room for a two stage supersonic gas jet and a momentum spectrometer, and III) a photon beam dump.

The differential pumping stage consists of a singly (turbo) pumped section with two apertures, an ion gauge and an x-y collimator. The photon beam dump is a simple pipe attached to the main chamber with a moveable Woods-horn at its end. The main chamber however is more complex. It has the following components (see “COLTRIMS_Sketch” in “Upload Files” of this AHD). In the source chamber the target gas gets introduced via a small nozzle (dia: 15 to 30 micron) using fore pressures up to 55bar (800 psi). The adiabatic expansion of the gas into the vacuum (1E-4mbar) forms a supersonic gas jet, which travels upwards through a small skimmer (0.25mm orifice) into the second stage chamber (1E-6mbar). This section collimates the gas beam and serves as a differential pumping stage for the target chamber which the gas beam enters after traveling through a small aperture (0.5mm orifice). In the target chamber (1E-7mbar) the gas jet intersects with the photon beam inside the momentum spectrometer, which is mounted in the center of the tank. The main part of the gas jet is sent to the jet dump (3E-8mbar) after traveling through a small aluminum pipe (8cm long x 1cm wide).

The spectrometer is equipped with two position and time sensitive Multi Channel Plate (MCP) detectors, with delay line readout at the two spectrometer ends. The charged particles (electrons and ions), which are created in the overlap region of the gas jet and the photo beam, are guided towards their detectors by weak electric and magnetic fields. From Time Of Flight (TOF) and the position of impact on the detectors, the 3D final state momenta of each particle can be determined in coincidence.

During the experiments the setup is closed and under vacuum. The gas jet is running, and the detectors, as well as the spectrometer and the Helmholtz coils (which generate the magnetic field) are supplied with DC electric power. The detector signals are decoupled from the vacuum feedthroughs and fed into electronic NIM modules. Two small sets of Helmholtz coils (named rainbow coils) are mounted to compensate the earth's magnetic field – both vertically and horizontally (not shown below).



This IHAD lists only the significant hazards associated with this activity. Significant hazards are those which; are elevated from a technical activity that requires specialized training and experience beyond that of a normal practitioner to conduct safety; and the risk of exposure to the hazards is sufficient to require that the hazard be mitigated.

This IHAD will be updated annually or whenever new significant hazards are introduced.

Identification of Hazards and Mitigations:

While maintaining and operating the COLTRIMS apparatus the following hazards are present:

Schedule: Electrical - High Voltage / High Current (>50V and >5mA)

1) Description of Hazard
Few tasks fall into this category which are allowed to be performed by a non-qualified electrical worker.

I.) life adjust of potentiometers of electronic devices such as NIM bins, CAMAC crates, (vacuum tube) monitors, (homemade) heat controllers etc.: the device needs to be energized to dial in the desired voltage. An electrical shock could happen when the worker touches energized components (>50V) directly or with a metal screw driver.
II.) changing fuses, fans and electronic boards inside the electronic device: the device needs to be opened in order to reach the fuses, fans or boards and exchange them. Some components may still be energized and shock the worker upon contact.
III.) flipping back tripped circuit breakers: blowing the fuse may have resulted from a defect in one of the devices connected to the circuit rather than from a temporary overload. Forcing the circuit breaker back may result in sparks, fire, or an electrical shock at the device or the circuit board.
IV) connecting devices to power outlets: regardless of the capability of the wall socket you can use any power cable and connector(s) dated for the appropriate voltage and current or higher than the approved equipment that is energized. This is safe for approved equipment that has a fuse. Possible overload of equipment and thus sparks, fire, or an electrical shock would only occur if it does not contain an appropriate fuse.
V.) vacuum pump, compressor or chiller maintenance and operation: gaskets, seals, oil (felts), cooling waters, filters or electronic control boards need to be changed depending on the device type and age. It is important to avoid electrical shocks and involuntary restarts of the device that could hurt the person working on it. Sometimes coolant needs to be topped of when the device is running. Moreover, sometimes the room temperature requires the device to be operated without its enclosure to prevent overheating.

2) Controls

a) Mitigation of Hazards

I) Adjust potentiometers: unplug the device from its power source. Then remove as few covers as needed while making sure the device is still properly grounded. Assess if the potentiometers can be reached without directly touching any energized component of the device; if this is not the case do not proceed and instead contact a qualified electrical worker. Use a screwdriver with the blade or handle made from non-conducting material (e.g. plastic) to reach the potentiometers and check if they can be turned (dry run). Now energize the device and adjust the screws. When done unplug the device from its power source again and reinstall all covers.
II) Changing fuses and boards: unplug the device from its power source. Wait one minute for any capacitors to discharge. Then remove as few covers as needed while making sure the device is still properly grounded. If applicable, disconnect any batteries while making sure that no lead is touching any conducting surface. Ground the prongs holding the fuses in place with a grounding cable (with alligator connectors at the ends for instance) for 30 seconds. Replace the fuses with new ones of the same specification. Reconnect the batteries. Reinstall the covers. Energize the device.
III) Reset circuit breaker: turn off all known devices connected to the disabled circuit. Locate the electrical panel and the right circuit breaker; in case of any doubts do not proceed but contact a qualified electrical worker. Reset the circuit breaker (only) once; in case the fuse blows again do not proceed but contact a qualified electrical worker. Restart your equipment subsequently; in case the fuse blows again repeat the procedure but do not restart the last device or contact a qualified electrical worker.
IV) Connecting devices to power outlets: Any cable and connector(s) that are capable of carrying >50V and >5mA should be inspected by a Qualified Electrical Worker. The to be energized equipment has to be AHJ approved and should therefore have a fuse and known capabilities.
V) vacuum pump, compressor or chiller maintenance and operation: for maintenance unplug the device from its power source. Wait one minute for power discharges and spinning down

of the machine. If applicable disconnect all batteries. Make sure the device cannot be accidentally plugged in again while working on it. Then remove as few covers as needed while making sure the device is still properly grounded. After the maintenance work reconnect the batteries, reinstall the covers and energize the device. If the device cannot be stopped for immediate maintenance or if the room temperature requires it to be operated with its enclosure off, remove as few covers as possible. Make sure the coolant or oil cannot splash any energized parts. Cover electrical feeds with customized (plastic) shields if device needs to be operated without covers beyond the immediate maintenance period (shut device down before installation).

b) Personal Protective Equipment (PPE)

Wear safety glasses with side shields or goggles.

3) Emergency Procedures

Call 7911 or 911 in case of any serious injury.

4) Maintenance

Make sure the plastic screwdriver and grounding cables are sized correctly and in working order. Check cables and plugs for damage before each installation.

5) Training

EHS0243, EHS0260, ENG1001

Schedule: Electrical - High Voltage / Low Current (>50V and <5mA)

1) Description of Hazard

The detectors and the spectrometer are supplied with high voltage (up to 4kV) via home-made decoupling boxes and voltage dividers. High voltage and low current electric power supplies (output: 4kVDC, 3mA) are used to operate the setup. Some of the home made boxes have small capacitors (<100 micro Farad) inside.

2) Controls

a) Mitigation of Hazards

High voltage exposed elements are shielded by the vacuum chamber (spectrometer) or the encasing (voltage divider, decoupling box) and cannot be reached in operation. The chamber frame as well as every single box needs to be grounded with the supplied cables before use. Whenever possible only SHV-SHV, BNC-BNC, and LEMO-LEMO cables are used. However, sometimes adapter cables such as SHV-BNC etc. cannot be avoided. In this case the cable must only be used according to the connector with the lowest voltage and current rating (1. LEMO, 2. BNC, 3. SHV etc.). During operation the electronic boxes must be closed. No voltage higher than 4kV shall be applied. In case of any queries do not hesitate to contact the electrical safety officer before using the equipment.

b) Personal Protective Equipment (PPE)

No special personal protective measures are necessary for protection. Wear the standard lab PPE (Personal Protective Equipment), as listed at the lab entrance. For soldering work the use of a fan to deflect hazardous fumes is recommended. Lead based solder has to be handled with gloves. Safety glasses or goggles must be worn. See “Safe_Soldering” in the "Upload Files" of this AHD.

3) Emergency Procedures

Turning the high voltage power supplies off eliminates any hazards.

4) Maintenance

To ensure a safe setup, operation and maintenance follow these guidelines:

Labeling: Label the in- and outputs of the boxes. It is recommended to put drawings or descriptions on the outside to inform you coworkers about the components inside the box. Mark special adapter cables clearly to avoid overloads.

Grounding: For metal encasings an extra grounding connection has to be provided which will prevent the box from charging up even if the signal cables have faulty shieldings. Ground the box before energizing it. Alternatively a plastic box may be used. Make sure that no potentiometers or switches which are on high voltage can be directly touched (plastic knobs for a safe operation need to be installed then).

De-energize: Before opening the box turn off the power supplies and disconnect the cables. Wait one minute for the small capacitors to be drained. In case capacitors are connected in a chain-fashion ground them individually using a grounding connector at each appropriate socket before working on the components inside.

Spark testing: In the event maintenance or repair is needed, a visual spark test may be necessary. In this case define and close off a test area, where high voltage can be applied safely, while the box is open and grounded or the spectrometer and the detectors are accessible. Perform the spark test with a collaborator and keep a distance of 1 m (or 3 feet), while voltage is applied. Turn off the power supplies and disconnect the cables before touching the components.

Spark gaps: No MHV connectors shall be used (because they can be mixed up with BNC). Instead of adapter cables it is recommended to build adapter boxes with spark gaps (<70V) inside if possible to prevent high voltages to be accidentally supplied to BNC or LEMO lines. The adapter box must have an additional grounding connector/cable.

When in doubt: Present the boxes to an LBNL electrical safety manager or electrical liaison for inspection.

5) Training

EHS0243, EHS0260, ENG1001

Schedule: Electrical - Low Voltage / High Current (<50V and >5mA)

1) Description of Hazard

I) The Helmholtz Coils are supplied with low voltage but high current. They are operated from a low voltage, high current power supply (output 30VDC, 300A).

II) Two small sets of Helmholtz coils (a.k.a. rainbow coils) are mounted vertically and horizontally to compensate the earth magnetic field. They are supplied with low power by using a low voltage, medium current power supply (output: 30VDC, 3A). A Rainbow Coil set is made from computer data cable. The special connection of the 50 x AWG 28 cables results in 2 parallel coil pairs. Each pair is connected in series. The vertically and horizontally orientated coils have an overall resistance of 12 Ohm per direction. Thus the equivalent circuit represents 2 AWG 22 coils in series, i.e., 1 Helmholtz coil pair, for each direction (horizontally and vertically).

2) Controls

a) Mitigation of Hazards

I) The Helmholtz Coils connectors are protected from contact and electric shortening by a plastic cover. Do not remove this cover while the coils are operating. Turn on the cooling water before electric power is applied to the coils. Do not tamper with the flow controller and the temperature sensor. They protect the system from overheating and electric shortening due to water leaks at the connection of the coils to the cooling waterline. Do not block the power

supply fans and air outlets. Otherwise the supply will overheat and malfunction. If possible, use cable bridges to isolate the bulky AC connection cable, and to prevent trip and fall incidents. The home-made Helmholtz Coils were presented to and inspected by the LBNL electrical safety Manager Keith Gershon; in case of any queries do not hesitate to contact him before you use the equipment.
II) Operation with a laboratory DC power supply (30 VDC, 3 Amps) will meet the current limits of the AWG 22 coils. Do not apply any voltage higher than 30 VDC.

b) Personal Protective Equipment (PPE)

No personal protective equipment beyond standard PPE, as mandated at the entrance to the laboratory or experimental ALS area, is required.

3) Emergency Procedures

Turning the power supply off eliminates any hazards.

4) Maintenance

I) In the event of malfunction, the power supply has to be repaired by trained technicians only. Maintenance of the connection of the cables to the Helmholtz Coils or repair of the flow controller or temperature sensor can be done when the power supply is disconnected from the coils; turn off the power supply first. The cover must be reinstalled before turning on power again.
II) Disconnect the rainbow coils from the power supply before any maintenance work.

5) Training

EHS0243, EHS0260, ENG1001

Schedule: Magnetism - High Fields

1) Description of Hazard

The Helmholtz Coils can generate an up to 40 Gauss magnetic field. State of the art pace makers should not be affected by a constant magnetic field, however caution should be exercised with older models (<1970). However, the magnetic field might be strong enough to erase data on credit or debit cards and affect other magnetic strip cards such as bus and subway tickets (BART). It can also damage your watch or computer monitor. Please see the **"Appendix: Magnetic Field Hazards"** to get detailed information about the harmful effects of magnetic fields.
The Rainbow Coils can generate a magnetic field up to 1 Gauss and are thus harmless.

2) Controls

a) Mitigation of Hazards

The magnetic field will be measured by an ALS safety officer prior to the start of an experiment. From this measurement the nominal hazard distance (5 Gauss demarcation line) will be determined and marked off.

b) Personal Protective Equipment

No personal protective equipment beyond standard PPE, as mandated at the entrance to the laboratory or experimental ALS area, is required.

3) Emergency Procedures

Turning off the power supply eliminates any hazards.

Schedule: Cryogenics Usage - Cold Traps

1) Description of Hazard

In order to improve the vacuum in the target chamber a cold trap (approx. 4 liters liquid N_2) is implemented in the chamber lid (see "COLTRIMS_Sketch" in the "Upload Files" of this AHD). A factor of 3 less in residual gas pressure can be expected by filling the trap with liquid nitrogen.

A second trap (approx. 1.2 liters) is used to pre-cool the supersonic gas jet by cooling the nozzle (not shown in the sketch). The same precautions and instructions as to the chamber cold trap apply (see below).

2) Controls

a) Mitigation of Hazards

LBNL cryogenic safety protocols, as per Pub 3000, will be followed. Do not overfill the trap and cover it with the supplied Plexiglas lid once it is full. In the event the trap needs to be emptied, use the available vacuum cleaner with a Dewar vessel and LN_2 approved and insulated Teflon hose (location: lab 2-102). Do not touch the metal suction spout when the hose is removed (note: it will be on LN_2 temperature, i.e. 80K). To avoid spills and splashes, do not apply any pressurized or warm air to the cold trap or stick in any warm or hot materials (such as copper pipes or stainless steal hoses etc.), while liquid nitrogen is still in the trap.

Since the volume of the trap for the supersonic gas jet is rather small, it is advised to fill the reservoir slowly and in subsequent steps when it is warm; this will avoid splashes and spills.

b) Personal Protective Equipment (PPE)

As a general rule, operators shall wear protective eyewear with side shields (or goggles) when working with cryogens. A face shield is optional when filling the traps. A face shield and gloves must be worn over the safety glasses or goggles when filling a Dewar at a pressurized cryogenic source tank. Always wear closed toed shoes and long pants.

3) Emergency Procedures

Call 7911 or 911 in case of any serious injury.

4) Maintenance

The Dewar vessels are inspected regularly for any damage or leaks; the Personal Protective Equipment is inspected regularly for damage and wear and tear.

5) Training

EHS0170, EHS0171

Schedule: Heavy Lifting – Crane Operation

1) Description of Hazard

The lid of the chamber (85kg or 180lbs) is removable and needs to be opened frequently. For this reason a removable manual crane mounted on an aluminum post, which is attached to the chamber frame, is provided. Before using the crane make sure the vacuum chamber sits on its feet only. Since the crane is made out of (magnetic) steel, it needs to be removed during data taking. The crane post may rest on blocks (such as tape wrapped or coated/painted lead bricks for instance) in order to match the height of the chamber, which varies with different beamlines of the ALS. Dropped loads or loads striking personnel can result in head and body injuries. Hand injuries can occur when handling the crane (rope etc.) or the load (e.g. edges and splinters).

2) Controls

a) Mitigation of Hazards

Since the crane is a bulky tall object it is recommended to take it on and off the post with two people. The operation of the crane is allowed by trained personal only (EHS0210). During operation, no personal under the load is allowed at any time, unless the lid is properly secured. Assure that the load travel path (vertical, horizontal) is clear of all personnel or objects. Prepare and obtain approval of an Engineering Safety Note for any High Value/High Consequence lift. Assure that slings, shackles, connection points and other rigging components are rated for the load. Inspect crane and rigging prior to use. Assure that hook is located over the center of gravity of the load before lifting.

b) Personal Protective Equipment

No personal protective equipment beyond standard PPE, as mandated at the entrance to the laboratory or experimental ALS area, is required. However additional personal protective equipment such as helmet, sturdy work gloves, and steel toed shoes are recommended.

3) Emergency Procedures

In case the crane fails, and the load drops, do not try to reach in and catch it. Call 7911 or 911 in case of any serious injury.

4) Maintenance

Before the first operation of the crane on a particular day the setup has to be inspected; using the provided checklist and logbook tied to the post. Every additional appropriate trained operator has to check the equipment again and must sign as well. These logs are kept in the logbook. Also the crane is inspected by trained and authorized LBNL personal twice a year; the inspector updates the tag near the handle – do not operate the crane if this tag is not up to date.

5) Training

EHS0210, EHS0062, EHS0056

Schedule: Heavy Lifting – Load Support

1) Description of Hazard

During the experiment the lid might have to be lifted but cannot be removed. In the event people now need to work under the lid, the load has to be securely supported.

2) Controls

a) Mitigation of Hazards

Use the provided 3 aluminum rods and screw them in-between the chamber flange and the lid. These rods are approved by a LBNL engineer and shall be used exclusively. (see “Chamber_Lid_Seismic_Study” in the “Upload Files” of this AHD). Make sure the rods are securely fastened. It is recommended to leave the lid attached to the crane as well, while the lid rests on the aluminum rods.

b) Personal Protective Equipment

No personal protective equipment beyond standard PPE, as mandated at the entrance to the laboratory or experimental ALS area, is required. However (if possible) additional personal protective equipment such as helmet, sturdy work gloves, and steel toed shoes are recommended.

3) Emergency Procedures

Call 7911 or 911 in case of any serious injury.

4) Maintenance
Before use, inspect the aluminum rods and 1/4-20 screws visually for any damages. Do not use them if they are broken. Do not work under the load without them.

5) Training
EHS0210, EHS0062, EHS0056

Schedule: Heavy Lifting – Ergonomics

1) Description of Hazard
The COLTRIMS apparatus is a transportable setup and is under constant development and use. This means heavy components and equipment such as flanges, lead bricks, pumps, and gas cylinders etc. have to be moved and mounted frequently.

2) Controls
a) Mitigation of Hazards
Worksmart Ergonomics training (EHS0062) is required. The use of lab jacks, supporting blocks and frames, carts and pallet jacks to lift and transport equipment is advised. Gas cylinders (>4 liters) have to be transported strapped to dedicated gas cylinder carts, with the pressure regulator unmounted and the protective cap screwed onto the gas cylinder. The chamber is on wheels and can be moved that way; however it is highly recommended to use a pallet jack to transport the setup from building 2 to the ALS and vice versa. Before transportation make sure the chamber feet are up all the way. In general, be sure you understand the load - assess its weight, size and balance. Get assistance with lifting heavy and/or awkward loads. Assure a clear path when moving loads.
b) Personal Protective Equipment (PPE)
No personal protective equipment beyond standard PPE, as mandated at the entrance to the laboratory or experimental ALS area, is required. However additional personal protective equipment such as sturdy work gloves and steel toed shoes are recommended.

3) Emergency Procedures
Call 7911 or 911 in case of any serious injury.

4) Maintenance
Inspect (gas cylinder) carts, pallet jacks, lab jacks etc. before using them.

5) Training
EHS0056, EHS0062, EHS0171

Schedule: De/Pressurized System – Vacuum chamber

1) Description of Hazard
In order to perform the experiments, the COLTRIMS setup has to be evacuated. Three main parts of the main chamber, i.e. the source chamber, the second stage, and the target chamber have to be pumped down and evacuated simultaneously. Pressure differences have to be balanced.

2) Controls

a) Mitigation of Hazards

The different sections of the setup are connected via bypasses (see “COLTRIMS_Sketch” in “Upload Files” of this AHD). These bypasses shall be opened during the pump down and venting phase in order to handle pressure differences between the three different sections of the setup and protect the skimmer and the small aperture of the gas jet system from damage. The 4 viewports of the apparatus, which may implode in the event of any damage or failure, while the chamber is under vacuum, shall be covered with separate protective quartz glass windows whenever possible.

If the gas supply lines of the supersonic jet fail or leak inside the chamber, the setup may experience excess inflow of gas from the gas cylinders. The excess gas flow rate is low enough so that it can be pumped out by the system vacuum pumps. In addition, a pressure relief valve is mounted on the source chamber in order to prevent over pressurizing the apparatus. Also, in order to completely exclude over pressure excursions from happening, the lid is only loosely mounted to the chamber flange while the gas jet is on.

b) Personal Protective Equipment (PPE)

No personal protective equipment beyond standard PPE, as mandated at the entrance to the laboratory or experimental ALS area, is required.

3) Emergency Procedures

Call 7911 or 911 in case of any serious injury.

4) Maintenance

All vacuum components and pumps shall be visually inspected for obvious damage (such as kinks and holes etc.) before pumping down the system after moving or changing the equipment or any long breaks in operation.

5) Training

EHS0171

Schedule: Compressed Gas, Flammable, Oxidizer – Gas jet

0) List of Gases

A file listing the current gases used in the COLTRIMS experiments and hazard analysis for components is available in the "Upload Files" section of this AHD: see “List_of_Gases_and_Hazards”. In the file Tables listed as follows are included.

Table 1: Gas Cylinder (Complete for ALL gases including inert gases).
Table 2: Gas Hazards (Complete for Flammable or Pyrophoric gases only).
Table 3: Accidental Release Analysis (Complete for Flammable or Pyrophoric gases only).
Table 4: Gas Hazards (Complete for Health Hazard gases only).
Table 5: Accidental Release Analysis (Complete for Health Hazard gases only)

Updates to these files will be made whenever new components are introduced or when listed components are no longer used. The Appendix located file will reflect current operating conditions. If the changes made in the updated file content do not result in any increase in hazard, no new authorization will be necessary. Determination of changing hazard level by a new item will be made by considering whether the hazard rating -HIGH or EXTREME- is sufficient to mandate a complete reauthorization.

1) Description of Hazard

The primary hazard in this setup is the accidental release of the supply gas for the experimental gas jet into the room and the inadvertent mixing of gases in the manifold (see

“Gas_Manifold_Sketch” in the “Upload Files” of this AHD). The gas manifold system allows connecting up to 3 gas cylinders at the same time to the supersonic gas jet of the COLTRIMS apparatus. The objective is to make switching between the different gases easy and quick. Special locking valves are provided to prevent the inadvertent mixing of gases in the manifold. There are two possible release scenarios: leaks from the gas jet supply lines and manifold, or leaks from the vacuum system pump exhaust.

2) Controls

a) Mitigation of Hazards

The experimental gas jet will primarily be operated using nonhazardous gases. In this case, no special hazard mitigation beyond standard safe gas handling procedures will be necessary.

An administrative (lockout) procedure called “COLTRIMSGasManifold”, which is available in the "Upload Files" section of this AHD, is in place to avoid mixing of incompatible gases and minimize accidental release of hazardous gas into the environment. If hazardous (toxic or flammable) gases are used, we will use the following mitigation procedures:

1. Gas supply:

The preferred approach will be to use the minimum size gas cylinder necessary for the experiment. Gas cylinders with sufficiently small volume may be used without a gas cabinet, as long as the total used gas volume is below the limits allowed for the used gas (see table 1a in Appendix). This reduces the maximum possible exposed gas volume. If larger gas cylinders are used, a gas cabinet will be used to contain the cylinders. (The volume restriction on gas cylinder size in section 1a- Appendix, still applies). The cabinets will be vented to the building exhaust. The gas line from the gas cabinet to the gas jet input (external to the cabinet) must be leak checked before use, and kept to a minimum practicable length.

2. Gas exhaust:

Exhaust lines from pumps connected to the vacuum system will be vented to the building exhaust. The gas pressure in the vacuum system will be periodically checked for system integrity.

b) Personal Protective Equipment (PPE)

Standard PPE must be used, as mandated at the entrance to the laboratory or experimental ALS area.

c) Hazardous Material Handling

The gas cylinders with hazardous gases will only be opened after proper secure mounting, and connection to a leak checked gas line system (incl. manifold). All gases will be handled using safe gas handling procedures. Used gas cylinders will be returned to the vendor, if possible. Contact EH&S for proper disposal procedures if you have cylinders, which contain hazardous gases and are nonreturnable.

3) Emergency Procedures

Call 7911 or 911 in case of any serious injury.

4) Maintenance

All high pressure lines, vacuum components and pumps shall be visually inspected for obvious damage (such as kinks and holes etc.) before pumping down or pressurizing the system after moving or changing the equipment or any long breaks in operation. Make sure not to tamper with the manifold when the gas bottles are attached to the gas inlets; note: only locking the valves is not sufficient – the gas lines have to be properly vented and the bottles have to be detached (for explanation see “COLTIMS_Gas_Manfiold” in the “Upload Files” of this AHD).

5) Training

6) Waste
When hazardous gases are used, all forepumps exhausts and the manifold outlet must be connected to the building exhaust.

Schedule: Seismic Safety

1) Description of Hazard
The COLTRIMS setup weighs about 450kg or 900lbs and is about 7 feet tall. During an earthquake the apparatus could move randomly or even tip over.

2) Controls
a) Mitigation of Hazards
In order to prevent the COLTRIMS setup from moving or tipping during an earthquake, the chamber has to sit on 4 support feet, which are securely hold to the ground by specially designed brackets. These brackets are approved by a LBNL engineer. Since these brackets are fastened to the ground with studs, which are embedded in the floor, there is only one position in the lab where the apparatus can be kept safely for long times. It is recommended to put cones on top of these brackets when the setup is moved out of the room, in order to prevent trip and fall incidents.
Since the experiments at the ALS do not last longer than 3 weeks, one unistrut bar with two threaded rods is used to clamp down the frame to the ground temporarily.
b) Personal Protective Equipment (PPE)
While fastening the chamber to the floor and dealing with the edgy brackets or unistrut bar, the use of sturdy work gloves is recommended. As always, wear the standard PPE as listed at the laboratory entrance or the experimental ALS area.

3) Emergency Procedures
Call 7911 or 911 in case of any serious injury.

4) Maintenance
The brackets and bar are checked visually for any damage before use. The components have to be replaced in case of any impairment.

Schedule: Thermal - Heater tapes

1) Description of Hazard
Heater tapes are routinely used for high vacuum bake out. Heater tapes are connected to power sources through Variac's (fuse protected power adjustment adapter).

2) Controls
a) Mitigation of Hazards
Do not cross heating tapes. Use special adhesive tape to keep the heater tapes in place. Cover the heating tapes with Aluminum foil. Make sure to connect only heating tapes with similar resistance to one Variac. Do not combine more than 3 tapes. It is recommended not to combine Variac's via multiple outlets in order to prevent overloading power outlets. For a new setup or for a combination of heater tapes and Variacs, start the heating process in ascending steps until you have reached and stabilized at the desired temperature. Monitor the

temperature with appropriate sensors. Use warning signs to prevent others from touching the hot surfaces. It is advised to inform the ALS control room about the bake out process.

b) Personal Protective Equipment (PPE)

Besides the standard PPE as listed at the laboratory entrance or the experimental ALS area, the use of sturdy work gloves or protective rubber gloves is recommended, in order to prevent cuts and skin irritation, during installation of the heating tapes. Use heat resistant gloves when you need to move the tape while it is warm. Do not touch the hot tapes with your bare hands

3) Emergency Procedures

Call 7911 or 911 in case of any serious injury. See the health personnel in building 26 for minor injuries. Cool burns with cold water while waiting for help.

4) Maintenance

Check the heating tapes before installation: Measure the resistance before and after installation (measure the resistance to ground as well).

5) Training

ENG1001

Schedule: Radioactive Sealed Sources

1) Description of Hazard

The sealed radioactive sources HC5630, 5631, 5632, and 5633 (activity: 1.0 micro Curie each) are used for testing Multi Channel Plate detectors with a delay line readout in the vacuum chamber which has an operating pressure of 1E-7mbar.

Sources will be mounted with a housing on a metal bracket/frame inside the chamber. The bracket will be placed approx.. 15cm above the bottom of the chamber so that I can illuminate the detector which is located at a distance of between 10 and 30cm away from the sources. The experiment is typically performed over 1 to 2 days.

When not in use the sources will be stored in a Radioactive Material Storage Area (RSA) in building 2-104.

Exposure to ionizing alpha radiation is possible.

2) Controls

a) Mitigation of Hazards

Remote handling tools (tongs, positioning systems, lanyards etc.) should be used whenever reasonable to maintain extremity and whole body dose as low as reasonably achievable (ALARA). The RSA shall be locked whenever unattended and sources that are not in use must be stored in there. A Radiological Work in Progress sign must be used whenever sources are sued and not continuously attended.

b) Personal Protective Equipment (PPE)

While handling the sources wear gloves and long pants.

3) Emergency Procedures

Contact the Sealed Source Program Manager (x2842)

4) Maintenance

Routine accountable source inventories and leak tests are performed by a Radiation Protection Group and radiological control technician every six months and routine exempt source inventories are performed annually.
A logbook must be maintained to record use of the sources in any location other than the immediate laboratory containing the RSA, or for use in the immediate laboratory containing the RSA for more than 48 hours. This logbook must document the source number, removal date, name of authorized worker removing the source, and return date.
Wear gloves when leak testing or cleaning the sources. Do not handle sources with questionable integrity.

5) Training
GERT, EHS0400, EHS0432 and documented on the job training are required

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Schedule: Computer Analysis

1) Description of Hazard
The analysis of the extensive amount of data during the experiments requires an intricate sorting and cleaning in an offline-analysis at a personal computer. The experiment is re-run hundreds of time under different software conditions in a C++ or Fortran code. Such an analysis takes 6 to 15 months requiring 6 to 8 hours work days in front of the computer. Ergonomic hazards such as strained wrists, backaches, fatigue or pain of the shoulder and neck area can be the result of infrequent breaks or a wrong computer desk setup resulting in a false posture.

2) Controls
a) Mitigation of Hazards
Adequate office desk and chairs which can be adjusted to the height and needs of the person analyzing the data as well as the right computer equipment such as ergonomically formed mice, keyboards, wrist pads or monitor stands and supports help to enable the right posture. Moreover software (RSI guard) from the LBNL software website can be installed to trigger frequent breaks and small exercises to stretch or walk (e.g., 5 minute breaks each hour, or more often if fatigue is felt). An evaluation by a LBNL ergonomic specialist or an ergo advocate is recommended. It is important to be proactive, i.e. to act before problems occur and even small aches should not be ignored but reported to the supervisor to prevent chronic injuries. Use neutral postures: straight wrist, arms/elbows at sides, and head/neck balanced over shoulders. Use keyboard shortcuts, alternate hands, and/or use alternate pointing devices to minimize mouse repetition. Adjust chair, keyboard/mouse and monitor settings to avoid awkward postures. Arrange tools for easy reach.
b) Personal Protective Equipment (PPE)
Seek out computer equipment that fit your needs. Contact the LBNL ergonomist or the ergo advocate(s) of your division for advice and to try out equipment and furniture.

3) Emergency Procedures
In case of any pain stop the work. See the health personnel in building 26. Contact your supervisor and the LBNL ergonomists.

4) Maintenance

With time your ergonomic needs may change. Test out new equipment and furniture if needed. Check your current furniture and equipment for full functionality and repair or replace what does not work for you anymore. Ergo software updates may be available.

5) Training
EHS0058 and EHS0059

Schedule: Hazardous Chemicals and Materials

1) Description of Hazard
The inside of the vacuum system, flanges and several components (spectrometer, detector etc.) that go in vacuum have to be cleaned with solvents such as Isopropanol, Ethanol, and Acetone for instance. These liquids are flammable and some of them are carcinogenic. Sometimes metal cleaners need to be used. Other hazardous materials you may get in contact with are glues, lead, machine oil, solder and indium.

2) Controls
a) Mitigation of Hazards
Do not drink or inhale the solvents – do not touch your face or open wounds after handling hazardous materials. Use as little chemicals of materials as possible. Put generated waste into the Satellite Accumulation Area (SAA) of your lab (do not drain them in the sink!) and inform your waste generator manager. Assure that emergency eyewash and/or safety shower are available for any use that poses an eye, face or body exposure hazard. Store and use all materials to avoid incompatibility reactions. Refer to the CHSP and MSDS. Clean up spills only as provided for in the red/white Emergency Response Guide (flip chart) and in the CHSP Consult MSDS for hazardous properties of materials including incompatibilities. Label containers of stock, in-process and waste chemicals properly per the Chemical Hygiene and Safety Plan (CHSP) and PUB-3092 Waste Generator Guidelines. Assure that all hazardous liquids are stored within secondary containment. Perform Exposure Assessment and utilize controls specified. Use properly functioning fume hood or other containment for any procedure that liberates hazardous particulate, vapor or mist. For flammables: Store quantities in excess of 10 gal/room in flammable storage cabinet. Store flammable hazardous waste in flammable storage cans, or glass bottles not exceeding 1 quart capacity. Assure that ignition sources are not present in flammable atmospheres. Assure that proper fire extinguisher is available.
b) Personal Protective Equipment (PPE)
Long pants, lab coat & resistant gloves must be worn when handling chemicals >0.5l or special or toxic chemicals of any amount. Additional PPE may be required. For help: consult the Material Safety and Data Sheets (MSDS) & PUB3000 or any other task specific procedure (e.g. OJT)

3) Emergency Procedures
Call 7911 or 911 in case of any serious injury. See the health personnel in building 26 for minor injuries. Inform your supervisor.

4) Maintenance
Order as little chemicals and materials as needed – try to avoid overstocking; check your inventory list. Discard old chemicals which are of no use anymore.

5) Training

Schedule: Incoming laser light

1) Description of Hazard

Infrared laser light and/or high harmonic laser light travels together with the fundamental through (vacuum) pipes to the endstation often with enclosed diagnostic or mirror stages in between. Moderate and high-power lasers are potentially hazardous because they can burn the retina of the eye, or even the skin. There are several covers and viewports installed where it is possible to manipulate mirrors, observe irises in the beam path or where the beam itself could exit the pipes or endstation. Theses sections are either directly covered with a nontransparent lid or a beam block or a nontransparent box is installed around a camera or other analysis tools that prevents the beam from exiting. As long as these covers are on the beam cannot harm the operator.

2) Controls

a) Mitigation of Hazards

All safety controls described in the LASER WPC project need to be followed. Under no circumstances the laser beam is to be viewed directly. The beam mode is to be observed by means of cameras, special viewers, or a card. When an operator wishes to remove the covers on the viewport flanges or optic boxes or reroute the piping, s/he has to follow the rules for changing laser modes described in the LASER WPC project; appropriate PPE has to be worn and appropriate barriers such as curtains or beam blocking barriers have to be installed and closed to contain the beam. The PPE and shields have to be chosen according to the laser class based on the power and wavelength (classes 1, 1M, 2, 2M, 3R, 3B, 4). Communicate your intentions to others present at all times e.g., before opening/closing shutters, removing beam blocks, or other actions that might put others (unintentionally) at risk.

The laser use area must be posted with an approved warning sign(s) that indicates the nature of the hazard. In the event of unattended operation of a Class 3B or Class 4 laser system the following controls shall be in place: a "NOTICE" sign shall be posted outside the laboratory which states that an unattended laser operation is underway.

Pay attention to housekeeping, making sure the immediate work area/bench top/optical table is free from opportunistic specular reflectors not needed. Your eye level should avoid the laser beam path/plane/height as much as possible (e.g. adjust the chair height of your work station).

b) Personal Protective Equipment (PPE)

Proper laser protective eye wear must be worn by all persons within the lab according to the mode of operation (“IR”, “alignment”: see LASER WPC). In case the laser is off or the laser beam is fully enclosed safety glasses with side shields or goggles (“class 1”) have to be worn as required by the specific lab PPE safety regulations (see entrance placards of the respective lab).

3) Emergency Procedures

Call 7911 or 911 in case of any serious injury.

4) Maintenance

The protective eyewear shall be stored in such a manner as to protect its physical integrity. Laser eye protection shall be inspected prior to each use to ensure that it is in good condition. All flange or box covers, beam blocks, shields as well as curtains need to be inspected for physical integrity periodically.

5) Training
EHS0288, EHS0302

Schedule: Miscellaneous

Please be aware or reminded of these hazards when you deal with the following:

- **Pumps:** The pumps are warm and noisy. Do not position the pumps next to heat sensitive equipment. Use earplugs or earmuffs or even combine them if you feel uncomfortable (please note that you have reached 90dB once you have to raise your voice in order to communicate with a person 3feet or 1m away from you; it is highly recommended to wear hearing protection then). Training is recommended (EHS0273 – Noise Exposure Awareness)
- **Noise:** High noise exposures can lead to hearing loss. Comply with the postings at the entrance(s) to the high noise area. Wear hearing protection per the posting. Contact LBNL Health Services for hearing test (EHS0285).
- **Power cords:** Many power cords and multiple outlets are needed in order to supply all pumps, controllers, electronics, and computers with electricity. Do not “daisy chain” multiple outlets and combine extension cords. That means do not form webs, nor do they loop back from the last device to the first. Please avoid trip and fall hazards dealing with these many power cords and cables; make use of cable bridges if possible or tape lines to the floor. The same applies to gas lines as well.
- **Electrical equipment:** Please make sure to ground the following (electrical) equipment before use: Electronic & controller racks, decoupling boxes, voltage dividers, chamber frame (ENG1001 - Electrical Safety and EHS0260 - Basic Electrical Hazards and Mitigations). In general assure that all electrical >50V AC or DC is shielded against contact.
- **Gas cylinders and pressurized systems:** Gas cylinders must be seismically secured. If there is no mounting frame available restrain the bottle in a gas cylinder cart, which is inhibited from moving by wooden chocks. When no gas line is connected to the gas cylinder, remove the regulator and protect the main valve with a cylinder cap, which is screwed onto the bottle. Store cylinders with proper separation between incompatible gases. Place window covers on any vacuum window >6" diameter except when actively using the window. Assure that all systems are equipped with pressure relief devices set below Maximum Allowable Working Pressure, or that all components are rated above the maximum available pressure (EHS0171 - Compressed Gas and EHS0170 - Cryogen Safety).
- **Ladders and stepstools:** Trips, slips, falls from heights, injuries to persons below from dropped objects are possible. If you want to use a ladder or step stool higher than 3feet or 1m, safety training is required (EHS0278 – Ladder Safety). You need training if a scaffold is higher than 3feet or 1m (EHS0279 – Scaffold Users Hazard Awareness). Inspect ladders for damage and/or broken rungs daily; remove damaged ladders from service. Sign, barricade or otherwise guard the area where the ladder is set to assure that others do not disturb or work below ladder. Assure that ladder feet are level and stable. Assure that step ladders are fully extended and locked. Do not climb higher than the third highest rung on a step ladder. Assure that extension ladders are tied off. Face the ladder and maintain three-point contact when climbing or descending. Keep both hands free (do not carry loads) when climbing or descending. Use personal fall protection if you must climb higher than six feet above the ground and are standing on any of the top three rungs of the ladder.

- **Open flames:** If you want to operate small torches for soldering or stripping capton insulation of wires a hot work permit is needed. Moreover, the designated Hot Work area must always be free of combustibles and flammables, even when not in use. (EHS0535 – Hot Work Permit Training).
- **Soldering:** Exposure to lead via incidental contamination possible. Wear safety glasses with side shields or goggles when soldering. Wash hands and face after completing lead work and before eating (EHS 0243 Soldering Awareness Training).
- **Sharps:** Using tools with exposed sharp edges or points (e.g., razor blades, scalpels, chisels, needles) can result in laceration or amputation of extremities or other body parts. Determine if a safer alternative to the edged tool can be used to accomplish the Work (e.g., wire stripper versus razor blade). If the edged or pointed tool must be used, evaluate available tools and pick the safest device that will accomplish the Work (e.g., scalpels with longer handles are often more controllable than razor blades; razor blade holders should be used rather than unprotected blades). When applying force, point the tool away from the body. Wear protective gloves whenever the Work permits. Cover edges and points or dispose as soon as the work is completed (e.g., into a sharps disposal container without re-covering the edge). Do not leave unprotected sharp or pointed tools on the work surface, in a drawer, or anywhere else that accidental contact is possible. Handle and dispose of contaminated, non-contaminated, regulated and non-regulated edged sharps into sharps or other containers in accordance with PUB-3093 "Medical and Biohazardous Waste Generator's Guide" and (if applicable) your Biological Use Authorization, Registration or Notification. If the edge or point is present on a machine, evaluate the machine for the necessity of Point-of-Operation Guarding.
- **Stationary and portable metal working tools:** Electrical shock, eye injury from flying objects, laceration can occur. Wear safety glasses with side shields or goggles when operating powered tools. Wear face shield in addition to safety glasses when operating any tool that produces flying chips. Always operate with supplied tool guards and/or chip shields in place and adjusted properly. Keep tools sharp. Wear protective gloves when laceration hazard exists and the task permits. However, do not wear gloves when operating machines with rotating parts (e.g., drill presses). Repair or replace broken tools immediately. Assure that cord-powered portable tools are either double insulated or grounded, and are plugged into GFCI-protected outlets.

Appendix: Magnetic Field Hazards

Guidelines for continuous exposure to static electromagnetic fields:
Note: 1 Gauss (G) = 0.1 millitesla (mT)

5 G	Highest allowed field for implanted cardiac pacemakers.
10 G	Watches, credit cards, magnetic tape, computer disks damaged.
30 G	Small ferrous objects present a kinetic energy hazard.
600 G	Allowed TWA for routine exposure (whole body).
6000 G	Allowed TWA for routine exposure (extremities).
20,000 G (2T)	Whole body ceiling limit (no exposure allowed above this limit).
50,000 G (5T)	Extremity ceiling limit (no exposure allowed above this limit).

Note: TWA exposure time is normally only a concern for extremely high field exposures to the whole body.

Explanation: Persons wearing metallic implants, such as bone or articular prostheses, surgical clips, nails or screws in broken bones, body piercing, or even dental fillings may feel painful sensations, if exposed to high magnetic fields. Persons fitted with pace-makers encounter a specific risk as static or pulsed magnetic fields may influence the working order of their pace-makers. Please see the following explanatory notes:

Metal associated with vessels

There is a potential danger of ferromagnetic hardware being displaced by the strong magnetic field. Coronary (heart) stents are MRI safe. Most carotid (neck) vascular clamps are safe at 1.5T (except Poppen-Blaylock clamp) but untested at 3T. Stents become firmly attached to tissues, and are unlikely to move beyond first few months. You can identify the exact device and see if it is listed as safe at http://www.mrisafety.com/

Other metal in the body

Metal bullets/shot/shrapnel in the head or torso should avoid kilogauss exposures. The only exception to this is implanted dental work in place for more than 6 weeks. Longstanding immobile bullets/shot/shrapnel in bones in the limbs are not a contraindication.

Non-removable piercings

We recommend that users should not be exposed to high magnetic fields with piercings in place as there is a small risk of heating, vibration or discomfort. Any unpleasant sensations/adverse reaction (pain, heating, vibration of piercing) must be reported to Health Services.

CSF shunts

Some are programmed magnetically, and will need the unit to be reprogrammed by their doctor after high field exposure

Tattooed eyeliner, tattooed eyebrows or Bigen hair dye

One may feel pain, heating, tactile sensations in the tattoo (and complete a peripheral nerve stimulation form if tactile sensations are experienced). Any unpleasant sensations / adverse reaction must also be reported.

Transdermal delivery patch (e.g. nicotine, contraceptive or medicated pain relief patch)

These may cause local heating. Remove before kilogauss magnetic field exposure.

Hearing aids & dentures (and removable bridge)

Remove before entering a high magnetic field.

Projectile Hazard

A danger frequently encountered comes from loose Ferro-magnetic objects present in a static magnetic field. If the field is strong enough, it will attract such objects from quite a distance and cause them to fly along the field lines towards the magnet. Watch out for any Ferro-magnetic objects you may carry in your pockets. Particularly objects with sharp edges may become dangerous projectiles. The use of Ferro-magnetic objects shall therefore be excluded from any high magnetic field. Non-Ferro-magnetic tools are available commercially.

Dynamic magnetic fields cause induced voltages, and the resulting currents either cause heating of metallic objects or disturbances in the human nervous system.

Controls:

Before you work near or in an area which has a high magnetic field ask yourself and your coworkers the following questions:

For exposure to magnetic fields of several hundred or several kilo Gauss

Absolute contraindications to entering the Magnetic field

- Do you have a heart pacemaker?
- Is there a possibility of metal in your head? (e.g. aneurysm clips, do not include dental work)

- Is there a possibility of metal in your eyes or have you ever needed an eyewash having worked with metals?
- Do you have an implanted medical device? (cochlear implant, metal ear tubes, bone stimulator, insulin or other medication pump, automatic defibrillator, internal pacing wires).
- Have you had any metallic dental implants (posts, crowns) within the last 6 weeks?
- Have you had any bone, tendon, spine or joint surgery within the last 6 weeks?

Potential contraindications to entering high magnetic field

- Do you have an IUD that may contain copper, or a contraceptive diaphragm?
- Have you had any stents, clips or surgery to any of any of your vessels (carotid artery vascular clamp, coronary stent, aortic clips, IVC filter, coils for blocked arteries)
- Do you have metal anywhere else in your body? (spinal rods, dental work, piercings, shrapnel, buckshot, bullets)
- Do you have any piercings that can't be removed?
- Do you have a cerebrospinal fluid (CSF) shunt? (treatment for hydrocephalus or water on the brain)
- Do you have tattooed eyeliner, tattooed eyebrows or Bigen hair dye?
- Do you wear a hearing aid or dentures?

Your best protection is to keep your distance to magnetic fields and their sources. Magnetic fields drop fast with distance. Try to stay behind the 5 Gauss demarcation line.

The 5 Gauss line is a demarcation between uncontrolled and control area. Similar to an ionizing radiation control area.

- Less than 5 Gauss no controls or posting required.
- Greater than 5 Gauss the pacemaker/electronic implant warning criterion
- 10-30 Gauss where credit cards, BART card stripes can be erased
- 30 Gauss projectile hazard starts
- At 600 gauss+ time weighted average exposure takes over

Users and Training

Training:

The following training courses are **required**

Course #	Description	Weblink
ALS1001*	Safety at the ALS	http://ehswprod2.lbl.gov/coursebuilder/course/courselogin.aspx?cid=77&sid=959
ALS1005*	Access to the ALS	http://ehswprod2.lbl.gov/coursebuilder/course/courselogin.aspx?cid=94&sid=1181
EHS0056*	Material Handling and Body Mechanics in Labs	http://www.lbl.gov/ehs/training/webcourses/EHS0056/
EHS0170*	Cryogen Safety	https://ehswprod.lbl.gov/ehstraining/TrainingLogin/login.aspx?course=EHS0170&url=http://www.lbl.gov/ehs/training/webcourses/EHS0170
EHS0171*	Compressed Gas	https://ehswprod.lbl.gov/coursebuilder/course/courselogin.aspx?cid=186&sid=2580
EHS0243*	Soldering Awareness	https://ehswprod.lbl.gov/ehstraining/TrainingLogin/login.aspx?course=ehs0243&url=http://www.lbl.gov/ehs/training/webcourses/EHS0243/
EHS0260*	Basic Electrical Hazards and Mitigations	https://ehswprod.lbl.gov/ehstraining/TrainingLogin/login.aspx?course=ehs0260&url=http://www.lbl.gov/ehs/training/webcourses/EHS0260/
EHS0348*	Chemical Hygiene and Safety	https://ehswprod.lbl.gov/ehstraining/TrainingLogin/login.aspx?course=ehs0348&url=http://www.lbl.gov/ehs/training/webcourses/EHS0348/
EHS0470*	General Employee Radiation Training	http://ehswprod.lbl.gov/EHSTraining/GERT/default.asp
ENG1001*	Electrical Safety	https://ehswprod.lbl.gov/coursebuilder/course/courselogin.aspx?cid=66&sid=694

Courses marked with * are available online.

The following training courses are **recommended**

Course #	Description	Weblink
EHS0062	Worksmart Ergonomics	http://www.lbl.gov/ehs/html/training_pdf/EHS62.pdf
EHS0273	Noise Exposure Awareness	Call x6266
EHS0278	Ladder Safety	http://www.lbl.gov/ehs/html/training_pdf/EHS278.pdf
EHS0279	Scaffold Users Hazard Awareness	http://www.lbl.gov/ehs/html/training_pdf/EHS279.pdf

Users will receive additional on the job training: see "Upload Files" section of this IHAD

Authorization Signoffs:

Name	Role	Signoff Date
Ali Belkacem	Division Director (Designee)	
David Rodgers	Review Team Lead	
Jerome Bucher	CH Division Safety Coordinator	

Thorsten Weber	Principal Investigator	

User Signoffs:
For detailed training information, see IHAD web application.

Name	User Type	Access Type	Tasks	Training Status	Signoff Date
	Authorized User	Fully Authorized		complete	
	Restricted User	Task Specific			

By signing off, Users have acknowledged that their participation in the activities described requires that they 1) understand the hazards and controls involved; 2) receive the appropriate training (including On the Job Training) prior to work; and 3) adhere to all appropriate safety procedures during participation.

EXAMPLE

1) Description of Hazard

2) Controls

a) Mitigation of Hazards

b) Personal Protective Equipment

c) Hazardous Material Handling

3) Waste

4) Emergency Procedures

5) Identify Users and Training